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cerity expounded this unsatisfying solution, by pain we are "driven ever onwards." Such consolations have stifled few cries or groans. The fact borne in upon all who were familiar with surgery in the pre-Lister days was that there was so much suffering to all appearance sheer waste; a heavy price was paid and nothing was gained; the way through discomfort and distress lay to more of both. And so we all instinctively place masters of the healing art, certainly those who have found new remedies and effective methods, among the great benefactors of men. They, and almost they alone, among inventors and discoverers have given much and taken from us nothing.

One further reflection must have been present to many in the Abbey yesterday. Lord Lister's discoveries and methods have opened up possibilities of still further advances, scarcely dreamed of before. The surgeon whom our ancestors regarded as the most highly paid of executioners is seen to be the possessor of an art the future of which is limitless. Lister and his coadjutors have shown what are the enemies to be guarded against and how they are to be encountered. He has opened a way which will be pursued, it may be confidently expected, with signal results. To use the words of the anthem yesterday, "His body is buried in peace, but his name liveth for evermore"; chiefly, no doubt, for his beneficent discoveries, but partly also by reason of the memory of his character, for all time the type of the faithful servant of science. Good as well as great, modest, genial, zealous in the interest of his patients, seeking truth unweariedly and calmly, he will, we do not doubt, be the model and example of men who will carry the art of healing far beyond the point which it has to-day reached.—*The London Times*.

SCIENTIFIC BOOKS

The Chemistry of the Radio-Elements. By FREDERICK SODDY. Longmans, Green and Co. 1911. Pp. 92.

There is probably no branch of modern science which has offered so great an attraction to the casual student as the subject of radio-

activity, and there is certainly none which has afforded a more unrestricted field to the ambitious author who, with but little first-hand information, has been eager to popularize the views of others or to support enthusiastically unsound doctrines based on a wholly insufficient knowledge of the fundamental principles or the value of experimental evidence. It is a pleasure therefore to be able to welcome the appearance of Mr. Soddy's book, written as it is by one who possesses so wide a knowledge of the topics treated and who has played so important and prominent a part in the development of the subject of radioactivity.

The book begins with a brief statement of the scope and objects of radio-chemistry. This is followed by a general discussion of the phenomena of radioactivity, the first discovery by Becquerel of the emission of characteristic radiations by uranium compounds, the general properties of these radiations, and the extension of our knowledge which resulted from the pioneer work of Madame and Monsieur Curie. To the novice in the subject, the text at this point is likely to lead to a somewhat exaggerated notion of the part played by the Curies in the development of the general theory, but difficulties of this sort are apt to arise in any attempt at a condensed treatment of so complex a subject, and the author has succeeded in preparing a distinctly instructive outline in which the more important facts are presented in a clear and orderly fashion. The characteristic differences in the relative permanence or stability of the different radio-elements are mentioned, the production by certain of these of gaseous radioactive elements or emanations is described, and the properties of the emanations themselves are briefly considered. Then follows a discussion of the interesting experiments on the radioactivity of thorium salts, which led to the formulation of the disintegration theory, and an outline is given of this theory in its more important phases.

The next topic treated is the general nature of the three types of radiation, the alpha, the beta and the gamma rays. The characteristic

properties of each of these are considered at some length and the evidence pointing to the identity of the alpha particles with charged helium atoms is clearly presented.

The second chapter is devoted to the radioactive constants and periods of average life of the radio-elements. Here, as elsewhere in the pages which follow, Mr. Soddy has shown a preference for denoting the relative stabilities of the different radio-elements by their so-called "average life" periods rather than by their "half-value" periods adopted and used by nearly (if not quite) all the other writers on the subject. To the reviewer the "average life" of a radio-element is merely the reciprocal of the constant of radioactive change, an occasionally convenient mathematical expression having little or no objective significance. Mr. Soddy defines it as "the sum of the separate periods of future existence of all the individual atoms divided by the number in existence at the starting point." The "half-value" period, on the other hand, is the time required for exactly one half of any given quantity of a radioactive substance to disintegrate or be transformed into other types of matter.

A very interesting and suggestive section on radioactive equilibrium completes the second chapter.

The title of the third chapter is the "Classification and Nomenclature of the Radio-elements.—Analogies Between the Three Disintegration Series," but the subjects covered are much more comprehensive than this heading would imply and include many topics of extreme interest and importance. In the opinion of the reviewer this chapter is the most valuable and illuminating portion of the entire book and the one to be most profitably extended and developed in future editions. It contains the essence of a new branch of science, radiochemistry, and Mr. Soddy has succeeded in collecting together and presenting in a relatively small space, and in a very impressive and convincing manner, much that has previously been accessible only in scattered scientific publications of his own and of other workers in this field of scientific in-

quiry. Thus, for example, the conditions determining the possibility of separating and isolating any given radio-element in a state of comparative purity are briefly but comprehensively considered, the general methods of obtaining the so-called "active deposits"—the solid radioactive products resulting from the disintegration of the gaseous emanations—are outlined, and the inferences to be drawn as to the true chemical nature of the different radio-elements from a knowledge of the behavior of these when mixed with large proportions of their apparent chemical analogues are discussed in some detail.

This general introductory matter occupies in all only thirty pages and one can not avoid a feeling of regret that it was not found practical to extend it still further. It is followed by a systematic presentation of the more important physical and chemical properties of the thirty-odd radio-elements thus far identified arranged in an orderly fashion under the separate headings, "Uranium," "Uranium X," "Ionium," "Radium," etc.

Mr. Soddy has provided us with a very valuable book of its kind, unique in respect to the field which it covers. It need scarcely be added that no one who desires to work intelligently in this modern branch of chemistry can well afford to be without it.

B. B. BOLTWOOD

Stability in Aviation: an Introduction to Dynamical Stability as Applied to the Motion of Aeroplanes. By Professor G. H. BRYAN, Sc.D., F.R.S. Macmillan and Co. 1911. Pp. xi + 192. Price, \$2.00.

Any one seriously at work on the theory or the art of aviation would profit by reading what he can of this book, though precious few will have both the time and the ability wholly to master it and probably none, not even the author of it himself, fully to solve all the difficult problems it sets.

The first chapter gives, in 18 pages of concise non-mathematical language, a summary of existing knowledge on aeroplane stability, and incidentally forms a good mental appetizer for the very solid intellectual courses that fol-